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ABSTRACT

This issue brief examines the gender salary gap in engineering, an occupation in which women held 10% of the jobs in 1995. Using multivariate regression analysis, various potential explanations for the salary gap in this field are explored. It was concluded that the salary gap is primarily explained by the fact that female engineers, on average, have fewer years of experience since obtaining their first baccalaureate degree than males. Salaries of male and female engineers with similar years of experience are virtually the same. (CCM)

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How Large is the Gap in Salaries of Male and Female Engineers?

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NATIONAL SCIENCE FOUNDATION
Directorate for Social, Behavioral, and Economic Sciences

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Division of Science Resources Studies

ISSUE BRIEF

July 26, 1999

HOW LARGE IS THE GAP IN SALARIES OF MALE AND FEMALE ENGINEERS?

The salary gap is primarily explained by the fact that female engineers, on average, are less experienced than males.

Recent studies have found that in the United States, women earn between 71-74 cents for every dollar earned by men.[2] However, such findings often do not take into account a variety of factors that alone or together may explain much of this gap between men's and women's salaries.

This issue brief examines the gender salary gap in engineering, an occupation in which women held 10 percent of the jobs in 1995.[3] Using multivariate regression analysis, the authors explored various potential explanations for the salary gap in this occupation. The study showed that the salary gap is primarily explained by the fact that female engineers, on average, have fewer years of experience since their first baccalaureate degree than males; salaries of female and male engineers with similar years of experience are virtually the same.

Using 1995 survey data from the National Science Foundation,[4] the study focused on U.S. residents who were employed full-time as engineers; these included approximately 1.5 million college graduates of all ages in 16 engineering occupations.[5] Within this population, the median salary for women was 13 percent less than the median salary for men; i.e., women in engineering earned 87 cents for every dollar earned by men, higher than that for the general population. This is consistent with other results that show that the earnings gap lessens significantly when women are compared with men with similar educational backgrounds and occupations.[6]

The analysis first explored whether men and women differed on a number of measures such as educational field (engineering vs. non-engineering), employment sector, geographic region, engineering specialty, highest degree attained, and years of experience. Regression analysis was then used to determine whether these factors, alone or together, could help explain the gender salary gap among engineers. This technique provides an estimate of the size of the salary gap if men and women were identical on these measures.

Occupational Characteristics of Males and Females

Men and women differed on these occupational characteristics:

[1] The authors are researchers at Abt Associates, Inc., Cambridge, MA. This study was supported by NSF's Directorate for Engineering, Division of Engineering Education and Centers.

[2] Castro, Ida, *Equal Pay: A Thirty Five Year Perspective*, U.S. Department of Labor, Women's Bureau. June 1998; *Gender Gap Theory Collapses Under Scrutiny*, Frontiers: Electronic Newsletter of NSF, January 1997; Institute for Women's Policy Research web page (1998) – http://www.iwpr.org/EE98.HTM; Fuchtgott-Roth, Diana and Stolba, Christine, *Women's Figures: An Illustrated Guide to the Economic Progress of Women in America*, American Enterprise Institute for Public Policy Research, March 1999.

[3] National Science Foundation, Division of Science Resources Studies, SESTAT (Scientists and Engineers Statistical Data System), 1995.

[4] These data were derived from SESTAT (Scientists and Engineers Statistical Data System), a comprehensive and integrated system of information about the employment, educational, and demographic characteristics of scientists and engineers in the United States. For more information, see the SESTAT Web page (http://sestat.nsf.gov).

[5] Unlike other publications using SESTAT data, this study included both computer software engineers and engineering faculty as engineering occupations. *Not* included are the engineering-related occupations of technical manager and engineering technologist. All engineers discussed in this brief have a baccalaureate or higher degree.

[6] See Hecker, Daniel, "Earnings of College Graduates: Women Compared with Men," U.S. Department of Labor, *Monthly Labor Review*, March 1998. Studying salaries of men and women within a single occupation like engineering avoids more complex approaches when comparing them across occupations in which men or women dominate, e.g., nursing and engineering, even when similar educational levels are normally required for each of the occupations being compared.

Electronic Dissemination

SRS data are available through the World Wide Web (http://www.nsf.gov/sbe/srs/). For more information about obtaining reports, contact pubs@nsf.gov or call (301) 947-2722. For NSF's Telephonic Device for the Deaf, dial (703) 306-0090.

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- **Engineering education.** Although most engineers had earned engineering degrees, a smaller percentage of female engineers had earned engineering degrees than male engineers (65 percent of women vs. 78 percent of men).

- **Employment sector.** There was a slight difference between men and women with respect to the sectors in which they worked. Women were better represented in local, state and Federal Government (17 percent of women vs. 13 percent of men) and less well-represented in private industry[7] (77 percent of women vs. 81 percent of men).

On average, women in engineering occupations had five fewer years experience than men.

- **Region.** Men and women were distributed differently in terms of residence, e.g., a higher fraction of female engineers lived in the Pacific Coast area (24 percent of women vs. 20 percent of men).

- **Engineering specialty.** The one specialty that showed greater female concentration was computer software engineering (26 percent of women vs. 13 percent of men). Most other fields showed greater male representation, e.g., electrical and electronics engineering (12 percent of women vs. 21 percent of men) and mechanical engineering (10 percent of women vs. 17 percent of men).

- **Highest degree attained.** The only notable difference was at the doctoral level with a higher percentage of men (5 percent) having doctorates than women (3 percent).

- **Years of experience.** Using the *time elapsed from the year of an individual's first bachelor's degree award* as a proxy for years of experience, figure 1 illustrates the different distributions of years of experience of male and female engineers. Higher percentages of female engineers were found among those with 12 or less years of experience. On average, women in engineering occupations had five fewer years experience than men. Figure 2 shows the relationship between this measure of experience and median salary. As expected, salary levels increase with years of experience. Further, the rate at which salary increases with experience is the same for men and women.

[7] Including self-employment.

Findings

The analysis shows that when controlling for years of experience in the regression, the estimated difference in salaries between men and women fell from 13 percent to 3 percent, bringing women's median earnings to 97 cents to the men's dollar. When the other variables listed above are added to the regression, the estimated difference is lowered only another 1 percentage point.

The remaining 2 percent difference cannot be explained with the available variables. Although statistically significant, the remaining difference is small compared to sources of errors such as the tendency to round salaries to the nearest $1,000, and the possible effect of factors not covered by the survey.

Limitations of the Analysis

The proxy for experience in this study would overstate the experience of those who may have temporarily left the workforce since graduating from college. Thus, if women's participation in the engineering workforce is more intermittent than men's, this analysis would underestimate that difference.[8]

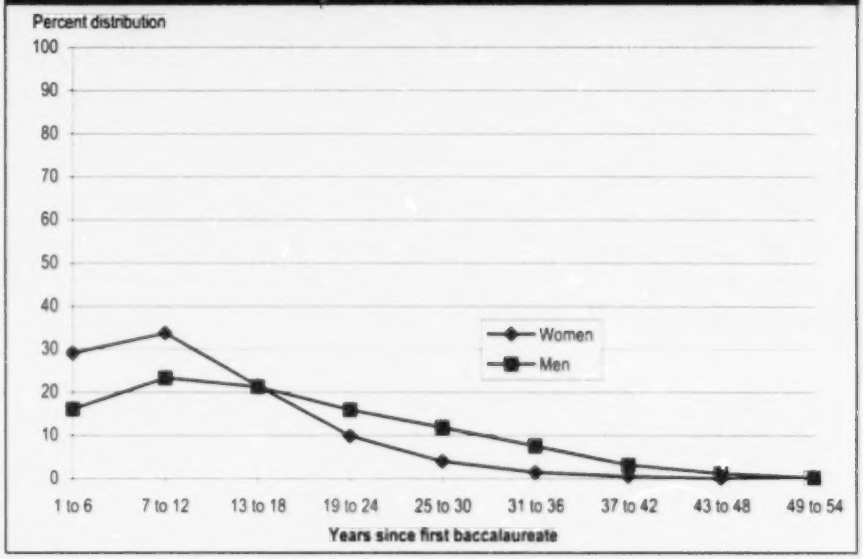
Further research in this area needs to consider other circumstantial factors that could enhance explanation of the gender salary gap in engineering. These factors include, but are not limited to, degree combinations,[9] worker productivity, quality of the school or department from which the individual received degree(s), quality of the employer, and lifestyle or family-related choices.[10]

[8] See Jacobson, Joyce and Levin, Laurence M. 1995. "Effects of Intermittent Labor Force Attachment on Women's Earnings." *Monthly Labor Review*. September, 1995. (pp.14-19).

[9] Burton, Lawrence, and Parker, Linda, *The Education and Employment of Engineering Graduates*. Arlington, VA: National Science Foundation, 1999, forthcoming.

[10] These factors were also overlooked in the chapter on salary gap in the NSF publication, *Women, Minorities, and Persons with Disabilities in Science and Engineering: 1996*. Arlington, VA: 1996, NSF 96-311.

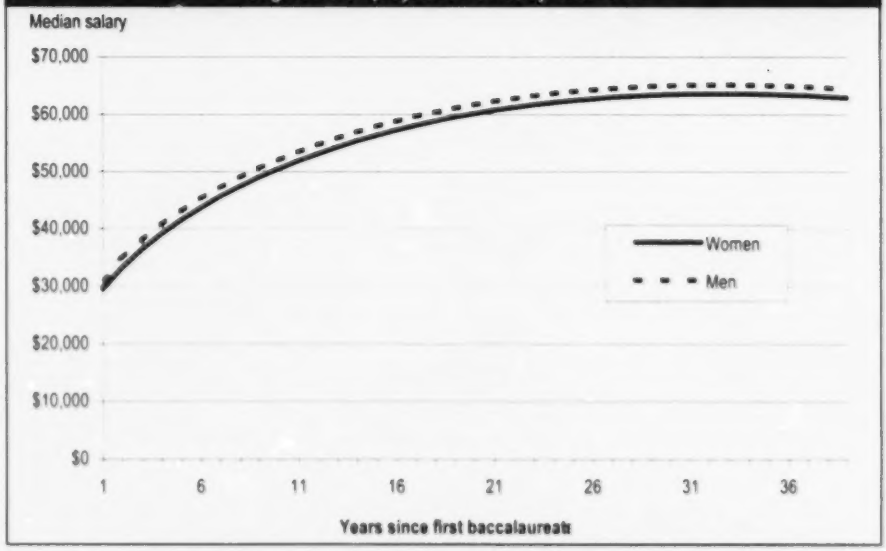
Figure 1. Percent distribution of years since first baccalaureate degree of U.S. engineers, by sex: 1995



NOTE: Plots in figure 1 are of full-time engineers in April, 1995 who were U.S. citizens or permanent residents.

SOURCE: National Science Foundation, Division of Science Resources Studies, SESTAT (Scientists and Engineers Statistical Data System), 1995.

Figure 2. Relationship between years since first baccalaureate and median salary of U.S. engineers employed full-time, by sex: 1995



NOTE: Plots in figure 2 are of salaries of full-time engineers in April, 1995 who were U.S. citizens or permanent residents. The figure shows regression estimates of the median salaries of men and women, grouped by years since first baccalaureate; no other variables were controlled. The figure was generated by applying polynomial median regression to the reported salaries, and a smoothing function was applied to the curves.

SOURCE: National Science Foundation, Division of Science Resources Studies, SESTAT (Scientists and Engineers Statistical Data System), 1995.

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We could not fully explore *why* there are fewer older women in the engineering workforce. One factor is a lower proportion of female engineering graduates 30 years ago than in recent years. However, the analysis also showed that women with engineering degrees were working in occupations other than engineering more often than men. Further analysis is needed to explore these issues.

Copies of reports related to the topic of this Issue Brief can be obtained from:

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